Definition of the Beef Distal Ileum

Beef small intestine is a valuable export commodity to U.S. red meat exporters. Exports of beef small intestine were estimated to be valued at over $9.0 million in 2003 to Japan alone and thus it should be considered a priority to maintain this market while maintaining the integrity of both the domestic and international food supplies.

It is well documented that the infective agent of Bovine Spongiform Encephalopathy (BSE), the prion, can be found in certain tissues of the distal gastrointestinal tract (Wells et. al., 1994) The agent has been documented to have been found in certain lymph-reticular system tissues called the Peyer's patches, which are concentrated in the distal ileum of the small intestine (Wells et. al., 1994). Current research indicates that the infective agent is not found in other bovine gastro-intestinal tissues other than the distal ileum (Wells et al., 1998). Specifically, research has shown that the infective agent is not present in the duodenum and the jejunum portions of the bovine small intestine even when the agent is found in the ileum (Terry et al., 2003). Additionally, the infective agent for BSE has only been found in the distal ileum of cattle which were inoculated with the BSE infective agent; due to the increased amount of infective agent the animals were exposed to; the agent has not been reported to have been found in bovine animals which have succumbed to the disease naturally (Wells et al., 1998; Terry et al., 2003).

Thus, the research and science have pointed to the distal ileum of the bovine small intestine as being a risk material for the BSE infective agent, albeit a small risk. The science and research also support that the distal ileum contains the only tissues in the bovine gastro-intestinal tract which contain the infective BSE agent. Therefore, the remaining portion of the small intestine should be allowed to remain as an accepted, edible product for human consumption. The following is a description of a method which would be suitable for use as a guideline for the removal and separation of the distal ileum from the remaining edible portion of the gastro-intestinal tract of bovine animals.

General Description

The beef small intestine that is processed for export to international market is comprised of the small intestine beginning at the stomach, including the duodenum, and the jejunum anterior to a point commonly referred to as the "flange". (Figure 1.)

The ileum of a beef animal will, on average, be 15 to 24 inches in length (dependent on age and size of animal). The ileum is very distinguishable as it is a very straight portion of the intestine (Figure 3.). The anterior portion begins where the cranial mesenteric artery ends and the ileum terminates at the cecum and colon. (Weaver, 1986; Habel, 1975; Schummer, 1979; Van Metre, 2003). (Figure 2. and Figure 3.)

The distal portion of the ileum can be generically defined as the portion, or half, of the ileum which is adherent to the cecum; thus estimated at one to one and one-half feet in

length (Habel, 1975; Van Metre, 2003). The proximal portion of the ileum being defined as the portion, or half, of the ileum which is adherent to the jejunum; thus estimated at one to one and one-half feet in length (Habel, 1975; Van Metre, 2003).

The flange is located in the distal jejunum; estimated at one and one-half to two feet from the end of the cranial mesenteric artery and the anterior ileum (dependent on size of animal). Removal at this point would include the entire ileum and a portion of the jejunum (Weaver, 1986; Van Metre, 2003). (Figure 1.)

The portion of the intestine removed would include the entirety of the ileum, thus including the distal ileum, along with a short portion of the distal jejunum; the removed items would equal approximately three to six feet in length (36 to 72 inches; dependent on age and size of animal). (Figure 2. and Figure 3.)

Processing Procedures

1. The small intestine is removed from the abomasum.
2. Separate the small intestine from the cecum at the ileocecal orifice. Separate the ileum from the jejunum at a point commonly referred to as the flange. The entire portion being three to six feet in length (36 to 72 inches; dependent on age and size of animal). Separation would be monitored by FSIS personnel prior to transfer of products to inedible rendering (ileum) and for processing (remaining jejunum and duodenum of small intestine).
3. Flush out and clean the remaining portion of the small intestine

Alternative removal:

1. Remove small intestine from abomasum.
2. Leaving small intestine attached to the cecum, measure a 36 to 80 inch section back through the entire ileum and into the jejunum, and make separation at that point.
3. Separate the 36 to 80 inch section from the cecum (leaving the cecum and large intestine for edible use) and dispose of the 36 to 80 inch portion containing the distal ileum.

* Leaving distal ileum attached to the cecum initially provides an easy point of reference for on-line verification of the length of the inedible portion by USDA or CFIA.
* Precedent - 80 Inches is an ultraconservative severance, for which precedent exists with prior precedent (i.e. Japan product specs prior to DEC23).

Verification (options)

1. Plant management will monitor procedure according to approved HACCP guidelines to verify proper procedures.
    a. Removal of the ileum would be designated as a critical control point and

this process would be directly verified by FSIS personnel. The process would be completed on the evisceration table in sight of FSIS personnel.

2. Plant management will monitor the procedure according to pre-requisite programs. This procedure would be verified by FSIS.
3. FSIS would oversee the process and verify that the procedure was correctly completed. However, the procedure would take place in a location which was not within site of FSIS personnel.

Note: The figures shown and referred to were taken from an approximately 1500 pound Holstein cow. Thus, it should be noted that the measurements shown would be, on average, larger than most animals slaughtered in the United States.

References

Habel, R.E., 1975; The Anatomy of the Domestic Animals: ruminant digestive system. Ed. 5, Philadelphia: WB Saunders Co. p. 904

Schummer A., Nickel R., Sack W.O., 1979; The Viscera of Domestic Animals. Ed. 2, New York: Springer-Verlag, p. 169

Terry, L. A., Marsh, S., Ryder, S. J., Hawkins, S. A. C., Wells, G. A. H., Spencer. Y. I., 2003; Detection of disease-specific PrP in the distal ileum of cattle exposed orally to the agent of bovine spongiform encephalopathy. The Veterinary Record; 152, pages 387-392

Weaver A.D., 1986; Bovine Surgery and Lameness. London: Blackwell Scientific Publications, p. 68

Wells, G.A.H, Dawson, M., Hawkins, S. A. C., Green, R. B., Dexter, I., Francis, M. E., Simmons, M. M., Austin, A. R., Horigan, M. W., 1994; Infectivity in the ileum of cattle challenged orally with bovine spongiform encephalopathy. The Veterinary Record; 135, pages 40-41

Wells, G. A. H., Hawkins, S. A. C., Green, R. B., Austin, A. R., Dexter, I., Spencer, Y. I., Chaplin, M. J., Stack, M. J., Dawson, M., 1998; Preliminary observations on the pathogenesis of experimental bovine spongiform encephalopathy (BSE): an update. The Veterinary Record; 142, pages 103-106

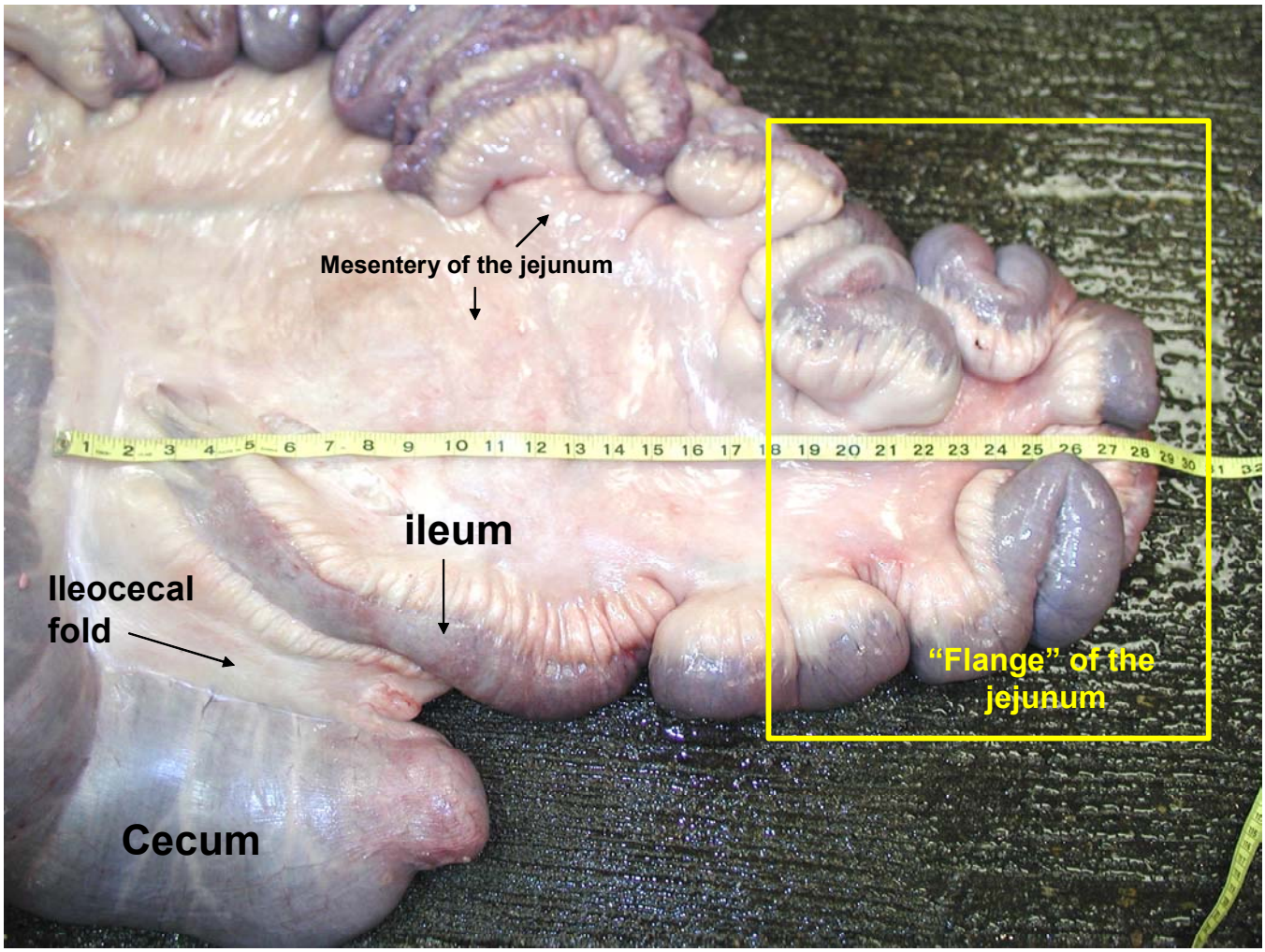
Van Metre D. C., 2003; DVM, DACVIM; Assistant Professor, Food Animal Medicine and Surgery, Colorado State University. Personal Telephone Interview. July 14, 2003.

The ileum is the straight, terminal part of the small intestine, passing cranially ventral to the cecum, to which it is connected by the ileocecal fold.

Thus, these definitions indicate that the ileum can be defined as that part of the small intestine attached to the cecum via the ileocecal fold. This is essentially the same segment of intestine as defined in the image above.

Photographs and definition of the bovine ileum
David C. Van Metre, DVM, Diplomate, ACVIM
January 13, 2004

Relevant Anatomy & Terminology



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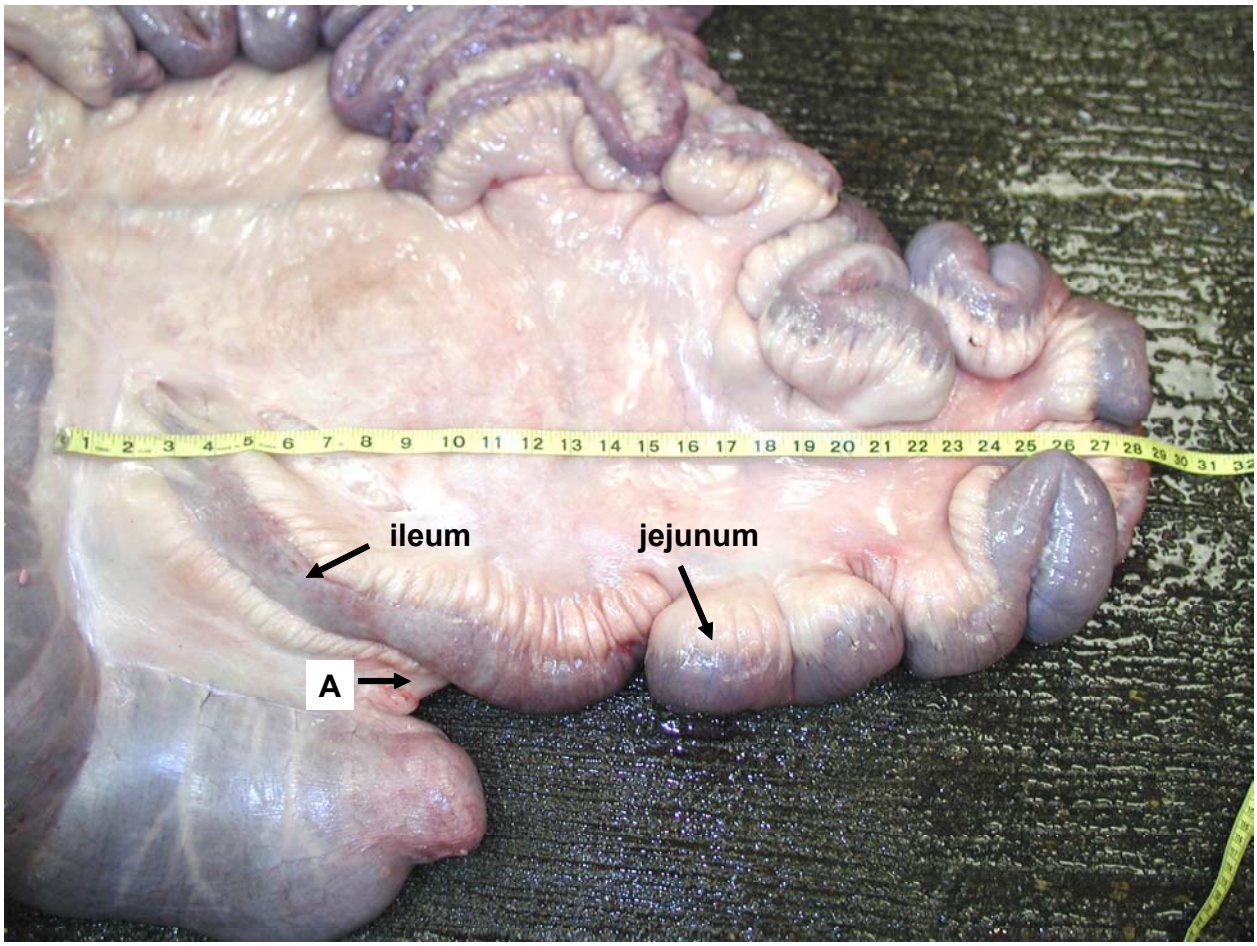
Published definitions of the bovine ileum

1. From Weaver AD, Bovine Surgery and Lameness. London: Blackwell Scientific Publications, 1986, p. 68:

> *The junction of the jejunum and ileum is the point where the cranial mesenteric artery ends, and the cranial limit of the ileocaecal fold.*

The cranial limit of the ileocecal fold is labeled as point "A" in the picture below. This is this author's definition of the junction between the jejunum (intestine to the right) and the ileum (intestine to the left).



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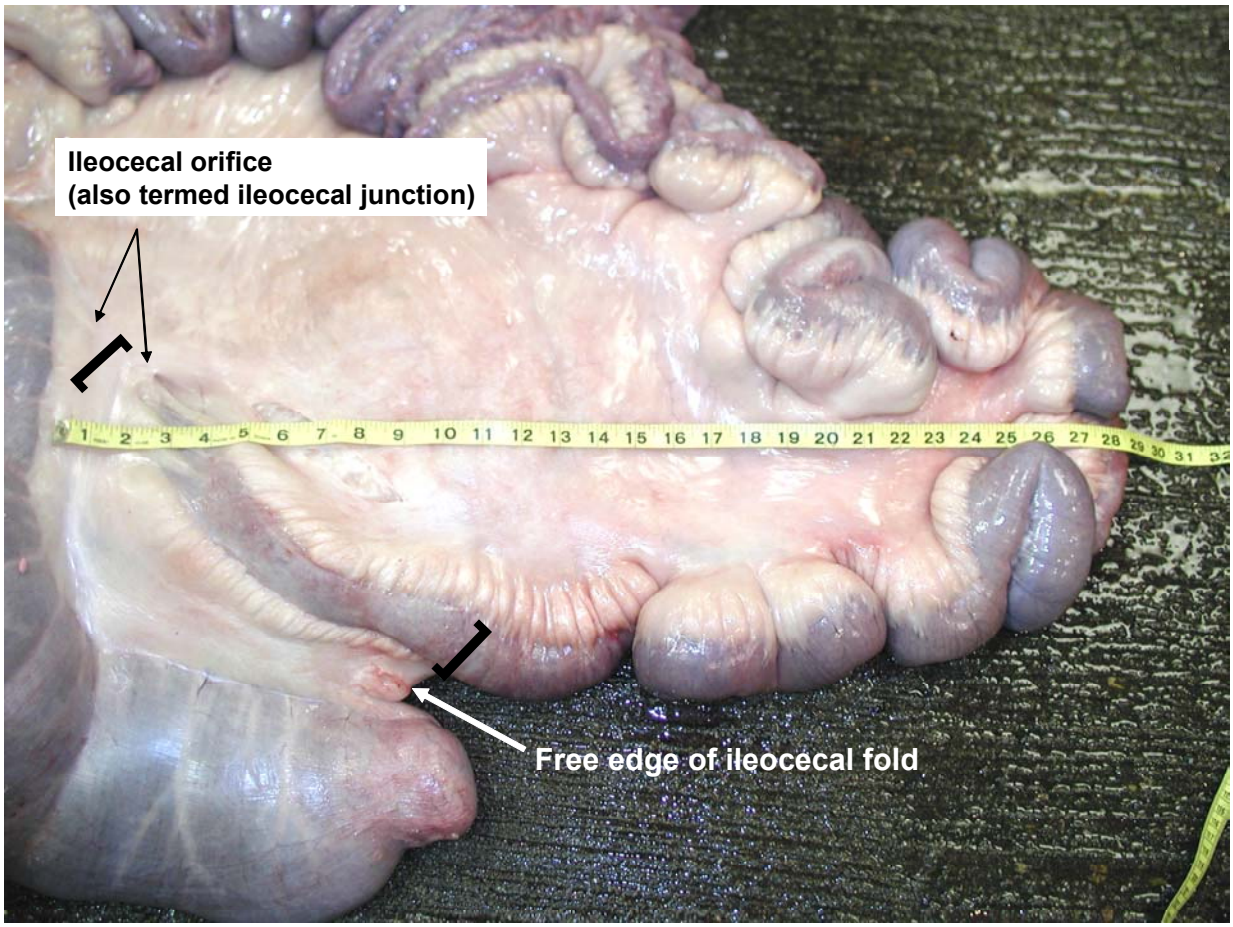
Published definitions of the bovine ileum

2. From Habel RE. Ruminant digestive system. In: Getty R, ed., The Anatomy of the Domestic Animals. Ed. 5, Philadelphia: WB Saunders Co., 1975, p. 904:

> *The ileum is defined as the terminal part of the small intestine, from the free edge of the ileocecal fold to the ileocecal orifice. Its cranial* [distal] *part is adherent to the cecum and colon* [brackets mine].

By this definition, the ileum would be contained within the brackets as shown in the photograph below:



3. From Schummer A, Nickel R, and Sack WO, The Viscera of Domestic Animals. Ed 2, New York: Springer-Verlag, 1979, p. 169:

> *The ileum is the straight, terminal part of the small intestine, passing cranially ventral to the cecum, to which it is connected by the ileocecal fold.*

Thus, these definitions indicate that the ileum can be defined as that part of the small intestine attached to the cecum via the ileocecal fold. This is essentially the same segment of intestine as defined in the image above.